SCIENCE.—SUPPLEMENT.

FRIDAY, JANUARY 1, 1886.

THE STUDY OF GEOMETRY.

We have a pernicious habit in this country of supposing, that, because in a republic all men are born equal as to their rights, they are also born equal as to their abilities. We have a different theory in regard to horses: we know that a race-horse is altogether different from a dray-horse, and we give him a totally different kind of life from the beginning. We have no trouble in recognizing him: we simply inquire who were his ancestors, and our expectation as to his qualities is carefully based upon the answer to that question. It would, perhaps, be a good plan if the young of the human species were divided into two groups at an early age, — one large and one small; one composed of those of whom nothing more than plain living is expected, and the other composed of the race-horses, of those whose ancestors, or whose chance endowments, give reason to hope that they may give some aid to learning or to culture.

There is, at all events, no reason why all young people should be taught geometry in the same way. For most children, a form of reasoning so abstract is not only repulsive, but very nearly impossible of comprehension. A little may be done for them (or for their descendants) by giving them a small dose of geometry, made as plain and easy and direct as it can be made: but they do not need to know every thing that can be done with the straight line and circle. Life is short, and the whole content of geometry as known to Euclid is long. For most children in schools, a good specimen of the kind of reasoning, and a fair knowledge of the principal results, are all that is desirable. For such, a geometry like Wentworth's serves a very good purpose.

But it is a pity that the kind of geometry a person is taught should depend upon his geographical position near this or that kind of a school. Any one whose destiny is to do difficult thinking in after-life should have a different kind of early training: he should dwell long among the geometrical concepts, should become thoroughly imbued with the bare and rigid form of reasoning, and should have the results as familiar as his mother-tongue. It is a serious loss to him if he is made to run over the subject with uncouth haste. Students of this kind will find their natural guide in such a text-book as Newcomb's or Halsted's.[1] In neither is it the aim to give the most rapid and cursory system possible. Both are written from the stand-point of the modern idea that the geometry of this world is not the only possible geometry, and that it is mere matter of accident that two parallel lines do not approach each other, and that two straight lines do not enclose a space. Both have felt the influence of the syllabus of the English association for the improvement of geometrical teaching. The idea of figure is shorn of its material content, and limited to its bounding lines or surfaces. The sum of two right angles is not regarded as a purely imaginary idea with no reality corresponding to it, but the 'straight angle' is allowed to play its natural part. In Professor Newcomb's book, his favorite idea is carried out of leading up to new and strange conceptions by very slow and gradual steps: Mr. Halsted's is intended for boys[2] of much more highly developed minds. There are no concessions to youthful weakness. It is also intended for boys of well-developed taste in the art of book-making. It presents a splendor of paper and of margin which is far removed from the republican simplicity of our ancestors.

The ancients believed that the geometrical concepts came down from heaven, but that the chief end of geometry was to measure the earth. We admit now that the concepts are, in the first instance, of the earth and earthy; but we have given an enormous development to the geometry of pure position, and have made it as remote from all possibility of application as the theory of numbers itself. It is in consonance with this development that in both these books measurement is given somewhat the position of an appendix to the subject, instead of being made to appear as the end towards which all the propositions lead up.

Mr. Halsted does an excellent thing in giving an introductory chapter on logic. When pure reasoning is about to become the student's daily occupation for many months, it is a pity not to give him a general view of the processes involved at the start. It

[1] *The elements of geometry.* By George Bruce Halsted. New York, *Wiley*, 1885. 8°.

[2] As a synonyme for 'student of geometry,' one should, however, say *girl* with the understanding that boys are to be included. Geometry is chiefly studied in the high schools, and the high-school graduates number three girls to every boy. If geometry is as good a specific against bad reasoning as is commonly supposed, logicalness will soon become a feminine instead of a masculine characteristic.

is very curious to find a compendium of logic with the syllogism left out. Hamlet is even less necessary to his play than the syllogism to logic. It is true, however, that the syllogism is an easy matter compared with inversion and contra-position. There is hardly a boy who is not greatly surprised to find that when he has proved that an isosceles triangle has two equal angles, it still remains to be proved that a triangle having two equal angles is isosceles. As De Morgan has pointed out, Euclid himself was apparently not aware that it follows every time from *A implies B* that *non-B implies non-A*.

In regard to 'his rule of inversion,' when three or more propositions are involved, Mr. Halsted has fallen into a slight inaccuracy. In the first place, if the term 'contradictory' is to be applied to three terms at all, it should be used in the same sense as when applied to two terms; the three terms should together cover the whole field, and they should not overlap. The word is a bad one for this purpose, however, and it is just as well to keep the two properties — that of being exhaustive and that of being incompatible — distinct.

In the second place, there is a redundancy in the rule as given by Mr. Halsted. From the three propositions,[1]

X implies x,
Y implies y,
Z implies z,

it may be inferred that

x implies X,
y implies Y,
z implies Z,

provided that *the subjects cover the whole field, and the predicates are incompatible.* It is not necessary that the subjects should be known to be incompatible, though it follows from the premises given that they are so, but also that the predicates are exhaustive. From the first two we have

X Y implies x y;

and, since there is no x y, there cannot be any X Y either.

It is very well worth while to have formulated the reasoning involved, instead of going through all the separate steps every time there is occasion for it, as the usual books on geometry do.

The conclusion does not follow if it is given that the subjects are incompatible, and that the predicates together fill the universe. The nature of the argument is most clearly seen in space. Lange believes that the logical laws of thought are derived from space-conceptions. Suppose there is a table painted in various colors, but so that

the red is all in the violet,
the yellow is all in the blue,
and the orange is all in the green;

and suppose, also, that the red, the yellow, and the orange together cover the whole table, and that the violet, the blue, and the green do not overlap: it follows that

red = violet,
yellow = blue,
orange = green.

To show how a somewhat complicated argument can be simplified by having this type of reasoning at command, we add a real illustration from algebra. In Descartes' method of solution of the biquadratic equation, the following relations are seen to hold between its roots and those of the auxiliary cubic: —

Roots of the biquadratic.		*Roots of the cubic.*
All real	*implies*	All real and positive.
Two real (unequal)	*implies*	One positive, two imaginary.
Two real (equal)	*implies*	One positive, two equal negative.
All imaginary	*implies*	One positive, two unequal negative.

But the division on the left is exhaustive, and the classes on the right are mutually exclusive: hence, by a purely logical *tour de force*, these propositions can all be inverted, and the desired inferences *from* the roots of the cubic *to* the roots of the biquadratic can be obtained at once.

Mr. Halsted's reviewers have pointed out before that he is deficient in a certain natural and becoming modesty. 'Two formative years' of his life is too high-sounding a phrase to be applied to any but a very great mathematician, like Professor Cayley, for instance.

[1] The letters stand for either terms or propositions.

CEREBRAL EXCITABILITY AFTER DEATH.

The problems of brain physiology are so complex, and our means of studying them, especially in the human subject, so insufficient, that it is not to be wondered at if rather out-of-the-way and venturesome experiments are sometimes undertaken by the anxious physiologist; as, witness the actual stimulation of the exposed brain in a patient whose death seemed certain. Such an experiment is not apt to be repeated; and a few French physicians have now wisely set to work to study the results of stimulating the cerebrum, exciting the sense-organs, and subjecting the whole body to a vigorous examination in the case of criminals who have suffered death by decapitation.[1] Such investigations are not new; but the results have been, as a rule, either entirely negative, or brought out only a few rather obvious facts. In the experiments about to be described, the methods

[1] *Revue scientifique*, Nov. 28. By J. V. Laborde.

of experimentation have been much improved, mainly by keeping up the spark of life, artificially, for a much longer time than was ever before accomplished.

A dog was prepared in such a way that a transfusion of blood from its carotid artery to one of the carotids of the head of the decapitated criminal could be promptly made, and thus a supply of living blood be made to flow through the lifeless head, and thereby preserve the excitability of the nervous apparatus. Into the other carotid (the right) of the head defibrinated blood at a suitable temperature could be injected. The head was received seven minutes after decapitation. The difficulty of finding the carotids in the soft tissues, which had become sadly disfigured by the decapitation, caused a loss of ten minutes. A small opening in the cranium was then made, so as to insert a pair of electrodes on the frontal parietal region of the left side, — the presumable motor centre for the facial muscles. At about twenty minutes after decapitation the double transfusion of blood was begun. The result was striking : a bright color returned to the face, which also assumed a natural expression. The effect was most marked on the left side, which received its blood-supply direct from the dog. The electrodes were inserted, but no result followed. Thinking this might be due to a stimulation of the wrong spot, they made another opening in the skull, and again stimulated the brain. This was followed by a regular and marked contraction of the muscles of the *opposite* side of the face, involving the orbicular and the superciliary muscles, together with a movement of the lower jaw, causing a strong chattering of the teeth. This effect could be repeated at will up to the 40th minute after decapitation, and, by increasing the current used in stimulation, to the 49th minute. After this no movement followed the application of the electrodes, although the facial muscles could be made to contract by direct stimulation of the muscles. The failure of the first stimulation was afterwards shown to be due to the unusual length of the head, thus causing an error of a few millimetres in the localization. At first the pupil could be made to dilate and contract by the approach or withdrawal of a strong light, — a fact frequently observed in previous cases. The peculiarities of the case are the great length of time for which the excitability remained, and the means employed for preserving this excitability, namely, the transfusion of living blood.

An opportunity of verifying these results presented itself in a subsequent case, but the results of cortical stimulation were negative. The explanation was offered, that the individual had furiously resisted the attempts of the officers to put his body in position for decapitation, and that the resultant neuro-muscular excitability prevented the orderly action of the electrical stimulation. However, a few new results were obtained. In the first place, the patellar or knee reflex, obtained by striking the tendon, was distinctly observed on the body. The contraction was perfectly normal. Another remarkable result was this : the cephalic end of the medulla was stimulated in hopes of exciting the nucleus of the hypoglossal nerve. The attempt was successful, and movements of the tongue such as follow direct stimulation of the nerve were distinctly observed.

Physiologists have not been very sanguine of results from this method of research ; but it seems that its importance has been rather underestimated. It will never be available for original investigations ; but it will serve as a means of verifying results otherwise obtained, and makes the inference from the facts with regard to animals to similar conditions in man more reliable.

PARASITISM AMONG MARINE ANIMALS.

IT is a curious fact that nearly all well-defended marine animals are either brilliantly colored or otherwise attractive, as in the case of the sea-anemone, jelly-fish, and tropical shells and crabs. Those with little or no defence are generally inconspicuous, or resemble surrounding objects. This may be explained by supposing that by being inconspicuous they easily escape the notice of their enemies. Brilliant, well-defended animals have little fear of enemies, and by their bright colors attract curious animals within reach of their deadly powers.

Many a fish in the sea instinctively avoids the deadly power hidden behind the brilliantly phosphorescent jelly-fishes. This protective light has saved the jelly-fish much trouble, and is a great aid to it in its struggle for existence among the multitudes of surface animals. Through some curious freak in evolution, an entirely inoffensive cluster of animals, devoid of any protective power, has gained the use of this phosphorescent light, and, by imitating the dangerous jelly-fishes in this respect, sails about the surface, inspiring terror among surface animals that could easily devour them. This cluster of animals is Pyrosoma. In the clusters of floating seaweed in the Gulf Stream there are vast numbers of tiny fishes attired in the color of the floating weed, and that certainly gain protection thereby.

The lump-fish has a sucker on its body by which it can attach itself to some fish of a similar

color, and go freely about, entirely free from danger. This is, no doubt, one way in which parasitism originated. At first an animal attached itself, for protection, to another having the same color; the next step was to burrow into the animal, and extract juices. There is a very curious fish that burrows in the side of another, leaving only a small opening out of which it can project its head and take food. Beyond this it does no harm to the fish. A curious case of parasitism is noticed in Penella, a copepod which burrows into the side of a sword-fish, and has upon its external stem a number of a peculiar species of barnacle, which in its turn has become parasitic.

The sting of the jelly-fish is deadly to nearly every animal of limited size; yet there is a small fish that habitually lives beneath the bell of the jelly-fish, in the midst of flying lasso-cells, without being injured. It manages to pick up a very good living from the crumbs left by the jelly-fish. What benefit it is to its host is hard to understand; but it is usually true, in such cases, that some service is returned. The habit of eating at the same table, or commensalism, is seen in many cases, that of the oyster-crab being a very good example. This crab lives within the oyster without offering harm, although it could easily destroy the oyster; but it is satisfied with what it gets, and leaves its friend alone. That such deadly powers as those possessed by jelly-fishes should have no effect, strange though it may seem, is hardly more wonderful than the power of resisting digestive fluids. In the stomach of a deep-sea sea-anemone a brightly-colored annelid is often found, in the digestive cavity. Whenever the anemone catches a fish, the annelid shares the meal without any injury to the anemone. Unlike intestinal worms, they are never numerous enough to be of any injury to their host.

This habit of one animal being dependent upon another for its existence receives a curious development in the case of deep-sea hermit-crabs and the sandy sea-anemones, of which Epizoanthus is an example. After the free-swimming stage, the anemone settles down upon the back of a shell inhabited by a hermit-crab, and begins to grow around the shell until it has entirely surrounded it, leaving only the entrance clear. The shell is eventually absorbed; and as the hermit grows, the anemone grows to accommodate him, so that he does not have to seek after a new shell. Thus the hermit is furnished with an accommodating, comfortable, and transportable house; but, in return, the hermit transports the sea-anemone from place to place, and keeps it upright. This is a curious case of division of labor among the lower animals.

There is a wide field for the study of the effects of hereditary instinct and evolutionary changes, as exhibited in the cases mentioned. Indeed, it would seem as if the best field for the evolutionist lay among the most degenerate types of an order, viz., parasites; for in their embryonic changes they pass through the higher stages of the past on their way to their present degeneration.

Ralph S. Tarr.

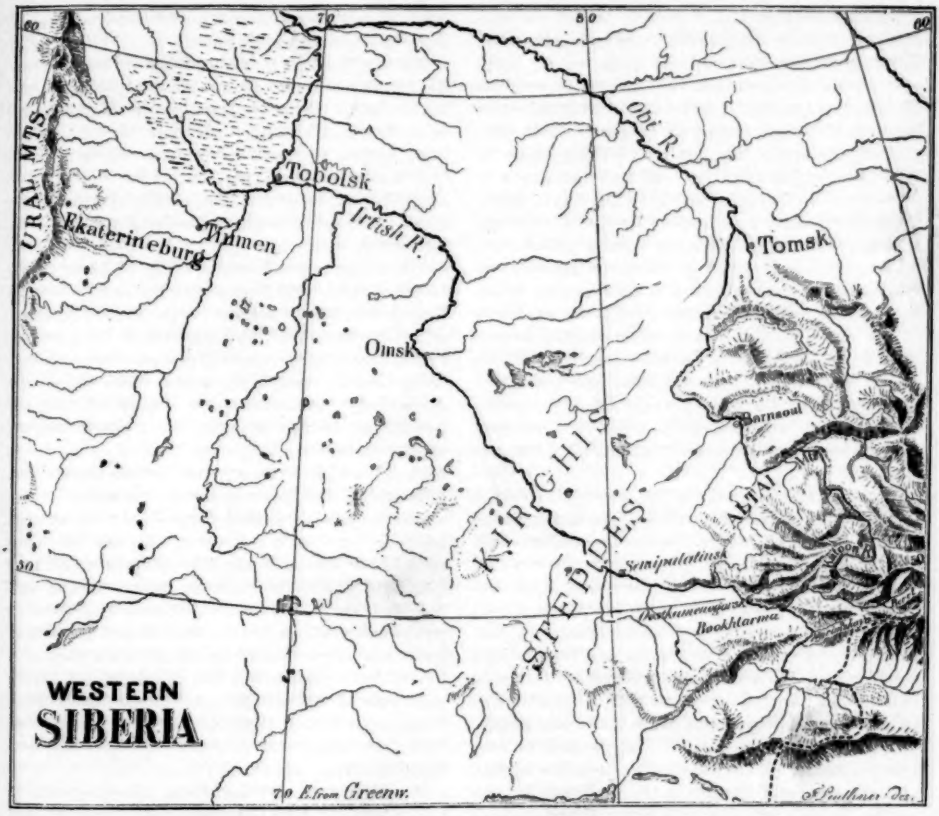
A TRIP TO THE ALTAI MOUNTAINS.

We left Semipalatinsk on Saturday, July 18, for a trip of about 1,000 versts, or 700 miles, into the wild mountainous region of the Altai. If you will draw a line on the map from the city of Tomsk, in a south by east direction, 600 miles or more, until it strikes the Chinese frontier, you will reach the region which I hoped to explore. The German travellers, Finsch and Brehm, went to the edge of it in 1876, but the high peaks lying farther to the eastward had never been seen by any foreigner, and had been visited by very few Russians. As far as the Cossack outpost known as the Altai Station, there was a post-road. Beyond that point I expected to go on horseback. The road runs from Semipalatinsk up the valley of the Irtish as far as the town of Oostkamenogorsk, and then turns away into the mountains, descending again to the Irtish at the station of Bookhtarma, and finally leaving it altogether at Bolshe-Narimskaya.

For 200 versts after leaving Semipalatinsk, the Irtish is bordered by a great rolling steppe of dry, yellowish grass. Here and there, where this steppe is irrigated by small streams running into the Irtish, it supports a rich vegetation; the little valleys being filled with wild roses, hollyhocks, golden rod, wild currant and gooseberry bushes, and splendid spikes, five or six feet high, of dark ultramarine flowers like larkspur; but generally the steppe is barren and sun-scorched. At Oost-Kamenogorsk and Oolbinsk I made the acquaintance of two very interesting colonies of political exiles, who received me with great friendliness and cordiality.

The farther we went up the Irtish, the hotter became the weather, and the more barren the steppe, until it was easy to imagine one's self in an Arabian or a North African desert. The thermometer ranged day after day from 90° to 103° F. in the shade; the atmosphere was suffocating; every leaf and every blade of grass, as far as the eye could reach, had been absolutely burned dead by the fierce sunshine; bleaching bones of perished horses lay here and there by the roadside; great whirling columns of sand, 100 to 150 feet in height, swept slowly and majestically across the sun-

scorched plain; and we could trace the progress of a single Kirghis horseman five miles away by the cloud of dust which his horse's hoofs raised from the steppe. I suffered constantly and intensely from the heat and thirst, and had to protect myself from the fierce sunshine by swathing my body in four thicknesses of heavy blanket, and putting a big down pillow over my legs. You can perhaps imagine what that sunshine was, when I tell you that I could not hold my bare hand in it without pain, and that wrapping my body in four thicknesses of heavy blanketing gave me at once a sensation of coolness. Tolerably familiar as I was with Siberia, I little thought, when I left Tiumen, that I should find in it a North African desert with whirling sand-columns, and sunshine from which I should have to protect myself with blankets. I almost laughed at a Russian officer in Omsk who told me that the heat in the valley of the Irtish was often so intense as to cause nausea and fainting (sunstroke?), and who advised me not to travel between eleven o'clock in the morning and four in the afternoon, when the day was cloudless and hot. The idea of having a sunstroke in Siberia, and the suggestion not to travel in the middle of the day, seemed to me so preposterous that I could not restrain a smile of half incredulous amusement. Governor Tseklinski, the military governor at Semipalatinsk, subsequently told me that he had seen the thermometer stand at 130° F. in the valley of the Irtish, with a sandstorm from the south, and that breathing during the prevalence of this simoom-like wind was attended with an almost insupportable sense of suffocation. We saw nothing so bad as that; but at the station of Voroninskaya, in the middle of the arid desert of the upper Irtish, we were overtaken by a furious sand-storm from the south-west with a temperature of 90° F. in the shade in our tarantass. The sand and fine hot dust were car-



ried to a height of a hundred feet, and drifted past us in dense, suffocating clouds, hiding every thing from sight, and making it almost impossible to see or breathe. Although we were riding with the storm, and not against it, I literally gasped for breath for more than two hours; and, when we reached the station of Cherem-shanka, it would have been hard to tell, from an inspection of our faces, whether we were Kirghis or Americans, — black men or white. Such wind, with such suffocating heat and blinding dust, I never in my life experienced before.

At the station at Mala-Krasnoyarskaya we left the Irtish to the right, and saw it no more. Late that afternoon we reached the first outlying ridges of the great mountain-chain of the Altai, and began the long gradual climb to the Cossack outpost known as the Altai Station. Before dark on the following day we were riding through cool, elevated alpine meadows, where the fresh, green grass was intermingled with blue-bells, fragrant spirea, gentians, and delicate fringed pinks, and where the mountain-tops over our heads were white a thousand feet down with freshly fallen snow. The change from the torrid African desert of the Irtish to this superb Siberian Switzerland was so sudden and so extraordinary as to be almost bewildering. At any time, and under any circumstances, the scenery would have seemed to me beautiful, but, after 2,000 versts of unbroken steppe, it made upon me a most profound impression.

We reached the Altai Station about six o'clock in the cool of a beautiful calm midsummer afternoon, and I shall never forget the enthusiastic delight which I felt as I rode up out of a wooded valley, fragrant with wild flowers, past a picturesque cluster of colored Kirghis tents, across two hundred yards of smooth, elevated meadow, into the little settlement of log-houses, and then looked about me at the mountains. Never, I thought, had I seen an alpine picture which could for a moment stand comparison with it. It was unsurpassed in my experience, and, it seemed to me, unsurpassable. I have seen since then the higher and grander peaks farther to the eastward, known as the Bailkee, where the Katoon River springs fully grown out from under enormous glaciers, and rushes away in a furious torrent to the Obi, through the wildest scenery in northern Asia; but I still think, that for varied beauty, picturesqueness, and effectiveness, the mountain landscape which opens before the traveller's eyes as he ascends out of the valley to the Altai Station is unequalled.

The station itself is a mere Cossack outpost of seventy or eighty log-houses standing in rows, with wide clean streets between, and with a quaint wooden church at one end. In front of every house in the settlement is a little enclosure, or front yard, filled with young birches, silver-leaf aspens, and flowering shrubs; and through all of these yards, down each side of every street, runs a tinkling, gurgling stream of clear cold water from the melting snows on the mountains. The whole village, therefore, go where you will, is filled with the murmur of falling water; and how pleasant that sound is, you must travel for a month in the parched, sun-scorched, dust-smothered valley of the Irtish to fully understand.

We remained at the Altai Station three or four days, making excursions into the neighboring mountains, visiting and photographing the Kirghis, and collecting information with regard to the region lying farther east which we proposed to explore. On Monday, July 27, we started for a journey of about 300 versts to the Katoonski Alps, or 'Bailkee,'— the highest peaks of the Russian Altai. Our trip occupied ten days, during three of which we lay in camp storm-bound in the Rakhmanofski valley, nearly 7,000 feet above the sea. The last sixty versts of our journey were made with great difficulty and some peril, our route lying across tremendous mountain-ridges, and deep valleys with almost precipitous sides, into which we descended by following the course of foaming mountain-torrents, or clambering down ancient glacier moraines, over great masses of loose broken rocks, through swamps, jungles of bushes and fallen trees, and down slopes so steep that it was almost impossible to throw one's body far enough back to keep one's balance in the saddle; while one's horse was half the time sliding on all four feet, and dislodging stones, which rolled and bounded for half a mile downward until they were dashed to pieces over tremendous precipices. I was not inexperienced in mountain travel, having ridden on horseback the whole length of the peninsula of Kamchatka, and crossed three times the great range of the Caucasus; but I must confess, that during our descents into the valleys of Rakhmanofski, the Black Berel, the White Berel, and the Katoon, my heart was in my mouth for two hours at a time. On any but Kirghis horses such descents would have been utterly impossible. My horse fell with me once, but I was not hurt. The region through which we passed is a primeval wilderness full of wild game. We saw marals or Siberian elks, wolves, wild sheep, abundant fresh traces of bears, chased wild goats on horseback, and could have shot hundreds of partridges, grouse, ducks, geese, herons, and eagles. The flora of the lower mountain valleys was extremely rich, varied, and luxuriant, comprising beautiful

wild pansies, — purple, yellow, cream-white, and variegated, — fringed pinks, spirea, blue gentians, wild hollyhocks, daisies, forget-me-nots, alpine roses, purple Altai lilies, and scores of flowers that I had never before seen, many of them extremely brilliant, large, and showy. Of plants and fruits, — which with us are domesticated, but which in the Altai grow wild, — I noticed rhubarb, celery, currants (red and black), gooseberries, raspberries, strawberries and blackberries, wild cherries, crab-apples, and wild apricots or peaches. Most of the berries were ripe or nearly so; and the wild currants, in particular, were as large and abundant as in an American garden. The scenery was extremely wild and grand, surpassing at times any thing that I saw in the Caucasus.

On Saturday, Aug. 1, we reached the foot of the last great ridge or watershed which separated us from the main chain of the Katoonski Alps. Sunday morning we climbed about 2,000 feet to the summit of the last ridge, and looked over into the wild valley of the Katoon, out of which rise the 'Katoonski pillars,' the highest peaks of the Russian Altai. I was prepared for something grand in the way of scenery, because I had already seen those peaks two or three times, at distances varying from 25 to 30 miles; but the near view from the heights above the Katoon so far surpassed all my anticipations, that I was simply overawed. It was not beautiful, it was not picturesque: it was overwhelming and stupendous.

The deep, narrow valley or gorge of the Katoon, which lay almost under our feet, was somewhere between 2,000 and 3,000 feet deep. On the other side of it rose far above our heads the wild, mighty chain of the Katoonski Alps, culminating just opposite us in two tremendous snowy peaks, whose height I estimated at 15,000 feet. Colonel Maiyfski, the governor of the district, has since told me that they are believed to be not less than 18,000 feet in height. They were white from base to summit, except where the snow was broken by great black precipices, or pierced by sharp, rocky spines and crags. Down the sides of these peaks, from vast fields of *névé* above, fell enormous glaciers, the largest of them descending from the high saddle between the twin summits in a continuous ice-fall of at least 4,000 feet. The glacier on the extreme right had an almost perpendicular ice-fall of twelve or fifteen hundred feet, and the glacier on the extreme left gave birth to a torrent which tumbled about 800 feet with a hoarse roar into the deep, narrow gorge. The latter glacier was longitudinally subdivided by three moraines, which looked, from our point of view, like long, narrow-shaped dumps of furnace-slag or fine coal-dust, but which, when I afterward climbed up on them, I found to be composed of black rocks from the size of my head to the size of a house, extending four or five miles, with a width of 300 feet, and a height of from 25 to 75 feet above the general level of the glacier. The extreme summits of the two highest peaks were more than half the time hidden in clouds; but that rather added to, than detracted from, the wild grandeur of the scene, by giving mystery to the origin of the enormous glaciers, which at such times seemed to the imagination to be tumbling down from unknown heights in the sky through masses of rolling vapor. All the time there came up to us from the depths of the gorge the hoarse roar of the waterfall, which seemed now and then to be almost lost in the deeper thunder which came from the great glaciers, as masses of ice gave way and settled into new positions in the ice-falls. This thundering of the glaciers continues for nearly a minute at a time, varying in intensity, and resembling occasionally the sound of a distant but heavy and rapid cannonade. No movement of the ice in the falls was perceptible to the eyes from the point at which we stood; but the sullen, rumbling thunder was evidence enough of the mighty force of the agencies which were at work before us.

After looking at the mountains for half an hour, we turned our attention to the valley of the Katoon beneath us, with a view to ascertaining whether it would be possible to get down into it, and reach the foot of the main glacier which gives birth to the Katoon River. Although the descent did look both difficult and dangerous, I was by no means satisfied that it was utterly impracticable. While we were discussing the question, our guide was making a bold and practical attempt to solve it. We could no longer see him from where we stood; but every now and then a stone or small bowlder, dislodged by his horse's feet, would leap into sight three or four hundred feet below us, and go crashing down the mountain-side, clearing two hundred feet at every bound, and finally dashing itself to pieces against the rocks at the bottom with a noise like a distant rattling discharge of musketry. Our guide was evidently making progress. In a few moments he came into sight on a bold rocky buttress about six hundred feet below us, and shouted cheerfully, 'Come on! You could get down here with a telega' (a Russian peasant's cart). Inasmuch as one could hardly look down there without getting dizzy, this was a rather hyperbolical statement of the possibilities of the case.

We finally reached a very steep but grassy slope, like the side of a Titanic embankment, down which we zigzagged with great discomfort, but without much actual danger, to the bottom of the Katoon

valley. As we rode up the gorge toward the great peaks, and finally, leaving our horses, climbed up on the principal glacier, I saw how greatly, from our previous elevated position, I had underestimated distances, heights, and magnitudes. The Katoon River, which from above had looked like a narrow, dirty-white ribbon, that a child could step across, proved to be a torrent thirty or forty feet wide, with a current almost deep and strong enough to sweep away a horse and rider. The main glacier, which I had taken to be about three hundred feet wide, proved to have a width of more than half a mile; and its central moraine, which had looked to me like a strip of black sand thirty feet wide, piled up in form to a height of six or seven feet, like a long furnace dump, proved to be an enormous mass of gigantic rocks three to four miles long, and three hundred to four hundred feet wide, piled up on the glacier in places to heights of seventy-five and eighty feet. In short, it was a tremendous glacier, and yet it was only one of eleven which I counted from the summit of the ridge between the Black and the White Berel. Seven glaciers descend from the two main peaks alone.

We spent all the remainder of the day in sketching, taking photographs, and climbing about the valley and the glaciers, and late in the afternoon returned to our camp in the valley of the White Berel.

Monday we made another excursion to the crest of the Katoonski ridge, and succeeded in getting a good photograph of the two great peaks without a cloud.

We returned to the Altai Station, Wednesday, Aug. 5, and two days later started back for Oost-Kamenogorsk. We were overtaken by a storm in the mountains between Bookhtarma and Alexandrofskaya; lost our way; our tarantass capsized into a hole about nine o'clock at night in the darkness; and we lay there until morning in a cold rain, without shelter, food, or fire. Shortly after daybreak help arrived from the nearest settlement; but it took eight horses and three drivers, two of the latter mounted, to get our tarantass to the next station. Geo. Kennan.

CURRENTS OF THE NORTH SEA.

The 79th supplement to *Petermann's mittheilungen* is by Prof. H. Mohn, director of the meteorological institute in Christiania, on 'Die strömungen des europäischen Nordmeeres.' The area thus designated lies between Norway, Novaya Zemlia, Greenland, Iceland, and Scotland, and has been examined by several exploring vessels, especially by Norwegians; so that tolerably full data as to depth, temperature, and salinity, have been determined from surface to bottom. On this basis, Professor Mohn has attempted a new style of investigation of its currents, fed on the south by the warm, dense waters of the North Atlantic; on the north, by the cold, fresher waters from the polar seas. His method is much like that which has been successfully applied to the study of atmospheric currents, and it has led him to very interesting conclusions. First, the density is examined, and the results graphically exhibited on ten sections. Next follow a series of detailed investigations, summarized in six maps, showing, 1°, surface isotherms; 2°, contour lines as determined by hydrostatic equilibrium, the North Sea thus appearing five centimetres higher than the ocean east of Iceland; 3°, the atmospheric pressure for the year, prevailingly low from Iceland towards the North Cape; 4°, the deformation of the surface of wind-formed currents by the deflective force arising from the earth's rotation, which depresses the central area about fifteen decimetres below the marginal; 5°, the same, due to both gravitative and wind currents; and, 6°, the summation of all persistent deforming causes. The currents themselves, as thus deduced, are shown in a larger map; their correspondence with what might be inferred from the isotherms establishes the correctness of the work. Finally, the pressure, temperature, and currents at depths of 500, 1,000, and 1,500 fathoms, are discussed and graphically illustrated in three pairs of maps. Taking this with an earlier monograph (supplement No. 63) by the same author, we have a very full description of the average physical conditions of these northern waters. The methods employed by Mohn may some day be well applied to the American Mediterranean from the Windward Islands around to the Bahamas.

W. M. Davis.

The venerable Professor Vilanova secured the indorsement of the International geological congress, at its last session, to the project of a polyglot dictionary of definitions and technical terms. He himself cannot do more than supply the Spanish-French part of such a work ('Ensayo de diccionario geográfico-geológico,' por D. Juan Vilanova), but he hopes others will take up and supplement his work, until a cyclopaedia of the sciences is produced in which any man can readily find exact statements of the facts in his own language, and their equivalents in all other languages. It is an important work, and the congress and all geologists will doubtless help him to the extent of their power.